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AMERICAN INSTITUTE OF CONSULTING ENGINEERS

PROCEEDINGS OF THE
ANNUAL MEETING

January 15, 1945

AND

ADDRESS OF GUEST SPEAKER

DR. HARDY CROSS
Professor of Civil Engineering
and Chairman of the Department of Civil Engineering
Yale University

ON

STANDARDIZED INTELLIGENCE

WITH DISCUSSIONS

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The Institute is not responsible for any statement made or opinion
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ANNUAL MEETING
of the
American Institute of Consulting Engineers

The Thirty-second Annual Meeting of the American Institute of Consulting Engineers, preceded by a dinner at 7 o'clock, was held Monday, January 15, 1945, at 8.30 o'clock at the University Club, 1 West 54th Street, New York City, Dr. Harold E. Wessman, President of the Institute, presiding.

The following members were present:

O. H. Ammann
George S. Armstrong
R. E. Bakenhus
George E. Barnes
Walter D. Binger
E. B. Black
Clinton L. Bogert
Henry Wolcott Buck
George H. Burgess
George V. T. Burgess
George W. Burpee
W. W. Colpitts
Hardy Cross
George C. Diehl
C. H. Dolan, II
Carroll A. Farwell
Shortridge Hardesty
Philip W. Henry
E. Rowland Hill
Maurice Holland
Leslie G. Holleran
W. W. Horner
Ernest E. Howard
Irving V. A. Huie
John P. Hubbell
Dugald C. Jackson
Ernest C. Johnson
George L. Lucas
David Moffat Myers
E. R. Needles
Lawrence E. Peterson
William M. Piatt
Malcolm Pirnie
A. C. Polk
Henry E. Riggs
Harry S. Rogers
Ralph R. Rumery
Thorndike Saville
Elwyn E. Seelye
Albert V. Sielke
Ole Singstad
C. G. Spencer
Carl H. Stengel
Henry C. Tammen
R. H. Tatlow, III
Arthur S. Tuttle
Edwin F. Wendt
Harold E. Wessman
Ezra B. Whitman
Charles S. Whitney

There were also present the following guests:

Frederick L. Ackerman
F. M. Baron
Lawrence W. Bass
Ruben N. Bergendoff
Bion A. Bowman
J. Bruun
James L. Carey
Harold V. Coes
George Denniston
Dean Edwards
Charles A. Ellis
John C. Evans
James F. Fairman
Chester A. Fulton
Raleigh W. Gamble
Elliott A. Haller
H. H. Henline
Asa B. Kellogg
Myles C. Kennedy
E. A. Kingsley
Lloyd D. Knapp
Fred Lavis
A. P. Learned
L. M. Mitchell
John I. Parcel
David Pierce
Clarence W. Post
Albert P. Sachs
R. L. Sackett
George T. Seabury
William J. Shea
Harold R. Sleeper
Alan L. Sielke
Homer R. Seely
John C. Stevens
Stephen L. Tyler
Burnside R. Value
John A. Willard

President Wessman: It is a great pleasure for me to have the privilege of welcoming to our thirty-second annual meeting our distinguished guests and fellow-members. I am sure that all of you will remember this meeting for it will be unique in more ways than one. In the first place, this is the only Thirty-second Annual Meeting that we will ever have; secondly, your presiding officer has already delivered his printed address to you. In the third place, we have one of our own distinguished members as the principal speaker.

One year has passed since the Council surprised me by electing an engineering teacher, one whose consulting practice is of secondary consideration, to the high office of President of the Institute. It has been a memorable year, and if you study our activities as recorded in the minutes of our meetings I am sure that you will reach the conclusion that your officers and Council have earnestly endeavored to further the objectives of this group.

We may have made mistakes, but in that connection let me recall the pungent remark made by President Theodore Roosevelt. He said, "Show me the man who has never made a mistake and I will show you a man who has done nothing."

On the whole, the work of the year has been extremely enjoyable. I say "on the whole" because there is a penalty in being a President. The distinguished guests at this head table should know what I mean. As a President you are expected to attend the annual dinners of other engineering organizations and listen to long-winded speeches on subjects in which you often have little interest.

I recall going to one dinner where one speaker with poor terminal facilities stopped at frequent intervals to drink from a glass of water. My neighbor finally turned to me and said, "I have seen lots of water pumped by windmills, but this is the first time I have seen a windmill run by water." (Laughter.)

Then there was the annual dinner of the American Society of Mechanical Engineers where I was introduced as the President of the American Institute of Chemical Engineers. Now, I didn't mind that, for I have a high regard for chemical engineers, but the very next day I concluded this was a dubious honor when I went to a meeting and heard Sidney Kirkpatrick, Editor of *Chemical and Metallurgical Engineering,* facetiously characterize the chemical engineer as the red tail-light on the train of engineering progress.

Distinguished Guests

In view of this, I have been particularly careful to get the names of our distinguished guests and their affiliations correctly. I know that you will be glad to know who they are.

We will appreciate it very much if you gentlemen will rise as your name is called so that we may have a good look at you.

On my right, Mr. Malcolm Pirnie, President of the American Society of Civil Engineers; (applause) Mr. J. S. Fairman, Vice-President of the American Institute of Electrical Engineers; (applause) Dr. Dugald C. Jackson, representing the Engineers Council for Professional Development; (applause) then on my left, Mr. C. A. Fulton, President of the American Institute of Mining and Metallurgical Engineers; (applause) Mr. H. V. Coes, Past President of the American Society of Mechanical Engineers; (applause) Mr. L. W. Bass, President, American Institute of Chemical Engineers; (applause) Mr. J. A. Willard, President, Association of Consulting Management Engineers; (applause) Mr. A. P. Sachs, President, Association of Consulting Chemists and Chemical Engineers; (applause) and Mr. Clarence W. Post, President of the New York State Society of Professional Engineers. (Applause.)

Activities of the Institute

Now, gentlemen, in order to preserve that unique quality which characterizes this meeting, we have decided to dispense with the roll call, the notice of the meeting, the reading of the minutes of the last annual meeting, and the Secretary's Report.

Mr. Henry has written a very fine report which will be published in the minutes of our meeting tonight, and I commend it to your attention. In passing, however, I should like to refer you in particular to several parts of the report; to the attempt of the Civil Service Technical Guild to prevent New York City from engaging the services of consulting engineers; to the action of our committee, composed of Messrs. Huie, Pirnie, and Proctor, to study the problem of overall representation of engineers in Washington; to the various resolutions on matters of national policy involving the interests of engineers; to the items indicating the development of closer relations with the United States Chamber of Commerce, such as Eric Johnston's appointment of one of our members, W. W. Horner, to the National Resources Department Committee — and he will need our sympathy because it looks as though that committee is going to have to study not only the Missouri Valley Authority but all the proposed TVA's around the country before they get through.

There is one additional item in that report which you should also note and that is the statement relating to Arthur Tuttle's plan suggesting necessary reconversion measures to stimulate employment after the war.

It is plans such as these which fulfill the fourth objective for which this Institute was organized; namely, "to increase the usefulness of the profession to the public at large."

ELECTION OF COUNCIL MEMBERS

The next order of business is the report of the Tellers' Committee on the vote for the new members of the Council. Will the Chairman of that Committee, Mr. Singstad, please report.

MR. SINGSTAD: Mr. President, we had an election before you came, and we elected Shortridge Hardesty as Chairman of the Tellers' Committee.

PRESIDENT WESSMAN: Will you kindly report, Mr. Hardesty.

MR. HARDESTY: He feels too modest to fulfill what I understood was his duty. I wish to report that the tellers opened and registered the ballots carefully. An adding machine would have been useful, but we didn't use one. We opened eighty-four votes and there was a three-way tie. George S. Armstrong received eighty-four votes, Walter D. Binger received eighty-four votes, Leslie G. Holleran received eighty-four votes.

PRESIDENT WESSMAN: Would you like to have a look at the new members of the Council? Mr. Armstrong, Mr. Binger, Mr. Holleran, will you kindly rise? George Armstrong was here earlier, but apparently he isn't here now. (Applause.)

I might say for the benefit of those who are guests tonight and who are not familiar with our procedure that we always complete the election of our Council in time for this Annual Dinner Meeting, but the officers for the ensuing year are elected by the Council at its meeting tomorrow, after which the committees for 1945 will be appointed by the new President.

INSTITUTE MEMBERSHIP

Now, gentlemen, I am sure you would like to know something about our membership which now totals 129. In 1944 ten new members were elected to the Institute. On the other hand, I am sorry to report that we lost an unusually large number through death. Ten of our members passed away during the year. Their average age was seventy-three years.

I wish I could tell you in detail of the distinguished records of these gentlemen, but that would take to long. Memoirs of all have been or will be sent to you, and, in addition, Mr. Henry has included in his report a brief outline of their careers.

Let me recall to you now, however, their names: Major J. P. Hallihan, who at the time of his death on January 1, at the age of 77, was serving as Chief of the Transportation and Engineering Division of the Foreign Economic Administration in Washington; Mr. George A. Orrok, authority on power plant engineering and senior member of the firm of Orrok and Myers in New York, who died April 6, at the age of 77; Colonel Herman F. Doeleman, consulting structural engineer in Baltimore, who died May 30, at the age of 70; John F. Coleman, Consulting Engineer in New Orleans and member of the Engineering Advisory Board of the Reconstruction Finance Corporation, who died June 3, at the age of 78; Frederic H. Fay, senior member of the firm, Fay, Spofford and Thorndike of Boston, who died on June 5, at the age of 72; Samuel M. Ellsworth, consulting sanitary engineer of Boston, who died August 13, at the age of 49; Colonel Henry M. Waite, Consultant, Bureau of the Budget for the United States Government in Washington, who died on September 1, at the age of 75; Albert M. Brosius, consulting sanitary engineer of New York, who died on October 9, at the age of 75; Alonzo J. Hammond, consulting engineer of Chicago and Assistant Chief, Price Adjustment Section, United States Army, who died on

December 2, at the age of 75; and Dr. Charles F. Scott, Professor Emeritus of Electrical Engineering, Yale University, who died on December 7, at the age of 80.

The death of these men is a great loss to the Institute, not only because of the number involved, but also because three of them, Colonel Doeleman, Alonzo Hammond, and Dr. Scott, were members of the Council this past year.

Will you rise, gentlemen, and pay silent tribute to the memory of these gentlemen, our distinguished colleagues, who have passed on to a world of eternal peace and rest.

(The audience rose and stood in silence for a moment.)

Now I would like to read you the names of the new members who have joined our ranks this year. As I call their names, will those who are here please rise and remain standing until I have completed the list. Then, gentlemen, I will ask you to welcome our new members with your applause when all are standing.

Professor George E. Barnes, consulting engineer in Cleveland and Chairman of the Department of Civil Engineering at the Case School of Applied Science; William C. E. Becker, consulting engineer, St. Louis; Craig P. Hazelet, consulting engineer of Chicago and Cincinnati; Ernest C. Johnson, consulting engineer, New York City; Marvin C. Nichols, consulting engineer, Fort Worth, Texas; C. G. Spencer, consulting engineer of New York City; Adolph G. Syska, consulting engineer, New York City; Harry R. Westcott, consulting engineer, New Haven; David Moffat Myers, consulting engineer, New York; and Robert T. Regester, consulting engineer of Baltimore. (Applause.)

I am sorry that all of our new members couldn't be with us tonight. On behalf of the Institute I welcome you to our membership, and I am sure that your new association will be mutually beneficial. (Applause.)

While on the subject of new members, gentlemen, I should like to remind you that there is a large number of prominent consulting engineers in this country, and, in particular, west of the Mississippi River who are not members of this Institute. May I urge you to assist in enlarging our sphere of usefulness by bringing in to our group those whom you consider qualified. I am delighted to note that another Texan came into our picture this year in the person of Mr. Nichols from Fort Worth. I hope that we will soon have more members from the fine State of Texas.

I would also like to say a word at this time about one of our members from St. Louis, Brigadier General Sverdrup, who is making a great record as a soldier out in the Pacific. As General MacArthur's chief engineer, he is the one who gets airfields ready after our men land on the islands. He has received the Distinguished Service Medal, the Silver Star, and the Purple Heart award. (Applause.)

In concluding my remark about membership, I would be remiss indeed if I failed to call your attention to the generosity of two of our members this past year. Each of these gentlemen presented a gift of one hundred dollars to the Institute because of the service rendered by our organization on behalf of consulting engineers. We will not embarrass these men by naming them, but we greatly appreciate their action in establishing such a fine precedent. (Applause.)

COLONEL E. R. NEEDLES: May I speak about General Sverdrup. I received a letter from him this last week, and I have received reports about him from others who have seen him out in the Pacific.

You speak very modestly indeed when you say he is making a great record as a soldier. He is doing a marvelous job out there. As you say, he has received the Purple Heart. He has been in a number of experiences which only a soldier out there who is in the thick of things could go through.

To show his enthusiasm for his job and his belief in what they are doing out there, he calls attention to the fact that they are going to finish up ahead of schedule, and he says that if the boys over in Europe don't hurry up they will have to call in the first team from the Pacific to help finish up for them. (Applause.)

PRESIDENT WESSMAN: We are delighted to have this additional word about General Sverdrup. In fact, I am delighted that Colonel Needles himself got up to note it because it gave all of you a chance to see another one of our distinguished members who is serving the United States Army. (Applause.)

I am sorry, gentlemen, that we do not have time to present all of the committee members who have done such splendid work for the Institute this past year. But I do want you to meet the man who has been responsible for the fine array of speakers who have addressed us, George Diehl, Chairman of the Program Committee.

George, won't you please stand up. (Applause.)

This committee was not listed in our Yearbook and, consequently, many of you did not know heretofore who deserved the credit.

To Ole Singstad and his Committee on Legislation, to Colonel Perring and the Development Committee, to Alonzo Hammond and the Committee on Professional Practice and Ethics, to Mr. Ammann who finishes his term as a Member of the Council, and to the special committees and representatives may I also voice my gratitude and appreciation for your generous service on behalf of all of us. (Applause.)

And now, gentlemen, the preliminaries are over. The time has come for me to deliver the presidential address, which is now printed here in full.

A Unified Profession

My talk to you this evening is not about a reality, but about a dream, a dream which is shared by many engineers in this land of ours. The central theme of this dream is the hope that the great engineering societies of America will again band themselves together in an overall organization through which they may exert one powerful voice on those matters of national interest in which all engineers have a common stake.

It has been estimated that there are more than 90 engineering societies* in the United States and that they represent approximately 200,000 engineers.

The largest one is the American Institute of Electrical Engineers with a membership of 22,600 in round numbers. Next comes the American Society of Civil Engineers with 20,400 members. The American Society of Mechanical Engineers has 18,600 members, whereas the American Institute of Mining and Metallurgical Engineers has 13,600 members.

These four societies constitute the group termed the Founder Societies. Then there is the American Institute of Chemical Engineers with 4,900 members. These five societies together represent over 80,000 engineers, but in general they speak with five different voices, if they speak at all. The Society for the Promotion of Engineering Education, whose members for the most part are also members of the preceding organizations, represents approximately 3,700 engineering teachers and administrators, but it has a voice all its own. There are other great engineering societies with their technical committees and their service committees, but in general each organization pursues its own way with no attempt to co-ordinate its program with that of other groups. Is it any wonder that the engineer's voice is seldom heard in Washington on matters of national policy? Any one group of engineers with sufficient interest in some issue to speak its mind will get at best only a perfunctory hearing, either because it doesn't carry enough weight or because another professional group voices a contrary opinion.

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* *The Engineer and His Societies*, H. O. Croft, Associated State Engineering Societies Bulletin, April, 1935.

Contrast the situation in the engineering profession with that in medicine and in law. The American Medical Association, with more than 120,000 members, represents the entire medical group. We do not find 50 independent medical societies. The American Bar Association has approximately 32,000 members and if it makes a statement of policy it speaks for the entire legal group.

Now, it is neither necessary nor desirable to wipe out 90 engineering societies and start anew with one comprehensive organization. But on the other hand, it is extremely urgent to establish a Congress or Council of Engineering Societies through which engineers can present a unified front to the nation. It is true there are difficulties involved in perfecting such an organization but I am sure that among the different branches of engineering there is enough wise counsel and organizational ability to overcome them. We have worked together in the Engineers Council of Professional Development and in the former American Engineering Council. We can work together again, profiting from past mistakes to achieve a harmonious, smooth-functioning, efficient agency through which we may express a unity of thought on those matters which concerns all engineers, regardless of branch or specialty.

An excellent example of the value of joint action was provided recently when the five presidents of the great engineering societies previously mentioned issued a statement suggesting a reasonable plan for handling German industry after the war so that never again would Germany have the industrial resources to plunge the world into conflict. But the Joint Conference Committee of Presidents and Secretaries, effective as it has been this past year, is not enough. The Presidents may live and work in close proximity one year. The next year they may be scattered over the country making it difficult to get together for discussions. Moreover, they only hold office for one year. Under such conditions, it is impossible to secure an effective continuity from year to year. As Congress and the Federal Departments evolve their plans for handling Germany and Japan after this terrible war, where is the permanent organization that will continue to press the viewpoints of engineers and scientists on problems which involve so many technical aspects but which are decided primarily by the lawyers who dominate our Government?

One of the tragedies which befell the engineering profession in recent years was the virtual death of the American Engineering

Council in 1940. It may be true that it had become somewhat ineffective, but instead of reorganizing it and making it a powerful voice in the affairs of this country, it was allowed to suffocate at a time when the need for such an agency was never more acute. I am sorry to say, gentlemen, that the American Society of Civil Engineers, of which I am a member, was primarily responsible for the end of the American Engineering Council. I hope that some day I may say with pride that the American Society of Civil Engineers took the initiative in organizing a new co-operative effort.

At the time when the activities of the American Engineering Council were suspended in 1940, the co-operating organizations consisted of 7 national engineering societies, 17 state and 28 local technical societies. I am glad to say that the American Institute of Consulting Engineers was one of these, that we held membership since 1928, and that our beloved Member and Councillor, Alonzo P. Hammond, was its last President. Until his death, Mr. Hammond cherished the hope that it would be revived in a more effective form, that the great engineering societies would again unite to form an agency "to further the public welfare wherever technical and engineering knowledge and experience are involved, and to consider and act upon matters of common concern to the engineering and allied technical professions."

If anyone believes that there exists no need for united action by the engineering profession in expressing opinions on national policy or on matters of common concern to all engineers, let him consider not only what has happened in the past few years but the implications of things to come.

I have already referred to the suggestions made by the five engineering society presidents for the handling of German industry when peace comes. This is only one of many technical problems that will arise in connection with the peace plans. The engineering profession has a distinct responsibility in these matters and if we do not help to decide them you may rest assured that they will be decided for us. Let me recall the statement made by Dr. Nicholas Murray Butler, President of Columbia University, last February to one of the divisions of the American Institute of Mining and Metallurgical Engineers. Dr. Butler said. "I repeat what I have said a good many times, that as a result of present-day conditions and of our war itself the two intellectual occupations which are to be most important and of greatest service in the years immediately before us are engineering and medicine."

The voice of the engineer should have been heard in Washington when Selective Service policies were being established in this country. As a result of our lack of foresight and unified action then, we now have ourselves to thank for a lost generation of engineers and scientists. I refer particularly to those who would have completed advanced study. Before the war is ended, most colleges will have experienced a four-year lapse in the full-time training of graduate students. Our national reservoir of potential research workers and qualified teachers was allowed to run dry. In this connection, it is of interest to note that when the Army abandoned most of its Specialized Training Program in the colleges, the American Medical Association immediately went to work and as a result the largest quota by far of those army men earmarked for complete training was allocated immediately to the medical profession.

There is the matter of labor relations for engineering employees. Here we find the American Society of Civil Engineers attempting to play a lone hand, when the problem is one which concerns all branches of engineering and one in which a common course of action should be pursued by all of the great engineering societies.

It is astounding to me that a group in the American Society of Civil Engineers proposes that local sections of this great society should organize groups of professional employees, embracing electrical, mechanical, and chemical engineers, for collective bargaining purposes without first establishing a liaison and common policy with our sister societies.

There is the problem of universal military service in peacetime. The Society for the Promotion of Engineering Education has a committee studying this question. Other technical societies have committees, I believe, to study the same question. But unless the engineering profession can present a unified front behind a plan whereby military training and the technical training of army specialists is co-ordinated with the engineering training given in college, I am inclined to believe that the plan finally adopted will be little to our liking. Most of us in engineering education have encountered many illustrations of misapplied manpower in this war. We hear from our former engineering students constantly about this. I am afraid there will be many more illustrations of this in the peacetime training plan unless the plan is so worked out that electrical engineering students will be used in military training where their electrical engineering background is of value and civil engineering students are used where their civil engineering training is put to the best possible use.

There is the question of the maintenance of War Department Research Programs in the years to come so that future wars.

should they occur, will not find us "behind the 8-ball" in scientific developments.

There is the problem of professional licensing which comes to the fore again by virtue of the recent decision of the Illinois State Supreme Court declaring the Illinois State Law unconstitutional.

There are problems associated with Post-War Planning and Reconversion. How to provide and maintain 50 million jobs in the face of a staggering annual Federal Budget which threatens to choke all incentive to private enterprise is a problem demanding the most intelligent consideration and co-operation by all groups in this land we love. I do not need to remind my readers that when a depression occurs, the engineer and scientist are placed on the defensive by charges that they have created technological unemployment with their labor-saving devices.

One does not have to look far to find other problems on which unified action by the engineering profession is of paramount importance.

I am not concerned in this paper with proposing the details of organizing a federation of engineering societies. I do suggest however that the Founder Societies and the American Institute of Chemical Engineers be urged to appoint immediately committees to meet in joint conference and draft the outlines of such an agency. Some defeatists will say that it will take a miracle to get engineers to agree on a common policy in connection with any issue. Well, we have already seen miracles performed by engineers in this war. Just recall the situation in 1939. A parade was held that year in New York City to display America's mechanized military might. Tanks twenty years old rolled down Fifth Avenue and broke down at a speed of three miles per hour. In that same year Congress appropriated enough to buy just 57 new planes for the War Department. It has been said that a single salvo by all the guns of our Navy at that time would have exhausted the entire output of gunpowder for the year. There is no doubt that we were woefully unprepared to resist aggression. Recall what has happened since 1939. The building program alone to house our Army and Navy cost more than all the buildings in New York City from Manhattan to the Bronx. Millions of tons of shipping have been launched. Over 230,000 planes have been built. Tanks, guns, ammunition, and all of the other paraphernalia of war — the record is amazing. Our enemies may say that we performed a production miracle and yet we know that it was essentially engineering brains and organizing genius that was responsible.

It will take no miracle to achieve a unified profession. But it will take some of that same organizing genius which has characterized the superb contributions of the engineer to our war effort. If our representatives go into organizing conferences with a spirit of compromise and the conviction that the area of agreement is vastly greater than any possible field of disagreement, then once again will we have an effective co-operation by the great engineering societies in a mission of service to the nation and for the profession.

Introducing Guest Speaker, Professor Hardy Cross

President Wessman: Now, it is my great pleasure to concentrate attention on the main speaker of the evening, my friend for many years, Hardy Cross.

Long ago, long before the sun grew hot and the moon grew cold, I used to sit as a student in the graduate classes conducted by Hardy Cross at the University of Illinois. Since then he has achieved great fame, and I must admit it was not because I was one of his students. (Laughter.)

We have another member of the Institute, however, who will tell you all about his distinguished record. Shortridge Hardesty has very kindly consented to introduce our speaker. (Applause.)

Mr. Shortridge Hardesty: We have the honor tonight to have as our speaker one of our own members who is also a distinguished teacher.

He gave early promise of ability when at the age of seventeen he graduated from Hampden-Sydney College as valedictorian of his class. The following year he received a B.S. degree from the same college. He received his B.S. degree in Civil Engineering from M.I.T. in 1908, and his Master in Civil Engineering from Harvard in 1911. Later he received the degrees of Doctor of Science in 1934 from Hampden-Sydney, Doctor of Engineering from Lehigh in 1937, and Master of Arts from Yale in the same year.

After some years of teaching and engineering practice, he became Professor of Structural Engineering at the University of Illinois in 1921. He remained there until 1937 when he became Professor of Civil Engineering and Chairman of the Department of Civil Engineering at Yale, which positions he now holds.

Professor Cross' work and teaching have been characterized by emphasis on intelligent thinking and clear analysis rather than on mere accumulation of knowledge and reliance on routine methods. He is perhaps best known for his analysis of continuous frames by distributing fixed-end moments, a method that emphasizes a clear understanding of the action of the frame rather than intricate mathematics.

His personal and professional characteristics are well expressed by the following citation made when he received the Lamme Medal for achievement in engineering education from the Society for the Promotion of Engineering Education.

"To Hardy Cross for his development of revolutionary methods of analysis in structural engineering for his application of these methods to the rigorous training of civil engineers; for his insistence on the great responsibilities of the individual teacher and his scorn of the superficial in education; for his pre-eminence in building men who are carrying forward his own high standard of straight, hard thinking in the teaching and practice of engineering."

I have had the good fortune to know Hardy very well, first indirectly by acquaintance through the ability of several of his engineering graduates, of whom your President is an excellent example, and later through frequent personal and professional contacts with Hardy himself.

He has chosen for his subject tonight one he is peculiarly fitted to discuss, "Standardized Intelligence vs. Individual Judgment."

Gentlemen, I present Hardy Cross.

(The audience rose and applauded.)

PROFESSOR HARDY CROSS: When I was asked to talk tonight I consented with some pleasure because of the high honor. To talk is a weakness as you know of college professors, in fact to a considerable degree they make their living by making up subjects meaningless to others and then explaining to others what they mean by the meaningless subjects. In the announcement, Mr. Henry says that I have a philosophical turn of mind as indicated by the title chosen, but in a letter to me he remarks that the title has in it cause for speculation as to what I intend to develop. The implied definition of philosophy delights me completely.

CAN INTELLIGENCE BE STANDARDIZED?

Of course you cannot standardize intelligence, of course there is no such thing as standardized intelligence. No one knows that better than you do. But it is possible to standardize certain things that have the appearance of being intelligent, of being learned, of being scientific, and to sell them and eventually to fasten them upon the imagination of humanity under the pretense that they represent culture, education, democracy and progress. I have become somewhat disturbed over this tendency as it seems to me to threaten us after the war. Perhaps I am merely a rebel against standardization. There is on the wall of the Faculty Club at Yale a framed sampler of the date of about 1840. Some young lady of a hundred years ago has woven into it this poetic gem:

"From early infancy I know
A rebel I have been
And daily as I older grow
The more I grow in sin."

Perhaps you must take this into account in interpreting what I have to say. The talk is not about the war but I think about certain possible effects of it — it is somewhat about engineering and especially structural engineering, but it is not much about engineers — it is somewhat about education but not about curricula. It deals with intelligence, but not too much I trust with standardization. Each year I discover how really ignorant I am about education, I am not sure that I know very much about the processes of standardization or that I properly interpret the term intelligence.

I am not talking tonight about prejudices. Frankly I am for them. They give a man something to hang on to in a storm. There is some virtue in our prejudices. I have none myself, but you have many. I have realistic convictions; yours are prejudices.

I am not talking tonight about false assumptions. We live with them, and to some extent we live by them. Certainly engineers are conscious enough of their existence. We fear them, try to avoid them, and never entirely do so.

My main thesis is that there is a recurrent threat to fasten upon us something which passes for intelligence though often not at all intelligent, that it is in part a result of imitation of engineering methods of standardization by those who are ignorant of the purpose of those methods and that engineers have an obligation to check the tendency so far as they can do so. The speech consists of fragments of knowledge and bits of ignorance, of hopes and fears and human dreams woven into an after-dinner patchwork. I am, however, not alone in my fears; other educators in several fields share them.

I want first to outline what I conceive to be the intellectual processes which go into structural engineering. I do this not because these processes are not already completely familiar to you but because they seem to offer parallels to similar processes in other fields. When we design a structure we ask successively three quite obvious questions. At least we should ask them, though sometimes we fail to do so. These are: Do you want something? Second: What do you want? Third: How will you use it? These three questions may not be asked or answered by one man, but all three must be asked and must be wisely answered.

When you want something it is appropriate to ask for what purpose you want it, at what cost or sacrifice you want and when and where you want it. The second question, what do you want, leads at once to the questions, what do you have, can you get it, and is it standard? The third question, use, involves problems of management, operation and finance.

I want to go in some little detail into the second question. Can you get it? To answer the obvious question what do you have, what is available, we need a general knowledge of types of construction, of materials available, of possible layouts, of general dimensions. The second question, can you get it, is critical. It involves careful study of construction procedures, of contractors, materials, labor, equipment, and time elements, of appearance, of architectural styles, of harmony between the architectural style adopted and the natural surroundings, of use and convenience, of the layout of bridges and approaches, of the planning of buildings and industrial plants and yards and terminals, of economy, costs, and values, and finally of the structural elements in the problem, of strength and stability and stiffness and of generally satisfactory performance of the structure without undue cracking or objectionable deterioration.

Most of our literature deals with strength and stability for the very good reason, not always obvious either to the amateur or the general public, that if a structure is not sufficiently strong it makes very little difference what other attributes it has. One might almost say that its strength is essential and otherwise unimportant. In determining this strength we secure evidence from various sources. No one of them is more important than another. Analyses and tests and experience and such intuitive common sense as you have been given or developed about structural stability — all of these can terribly mislead. Evidence from various sources rarely agrees completely. An engineer weighs this evidence and from judgment as to its dependability arrives at a reasonable answer.

The third question, is it standard, is another matter. The materials to be used must be such as are of standard manufacture; the advantages of standardization here are obvious to all engineers and are a large factor in our success in the war. The loads and methods of analysis and stresses allowed must conform approximately to some standards which for certain types of work is narrowly circumscribed and for other types of work leaves much latitude to the designer. There is a good deal of convenience in standardizing construction methods and materials and methods of fabrication and criteria for stability.

But there is another purpose of standardization here and in most engineering fields. The time came long ago when we had more work to do than we had men or time in which to think out our problems. It became desirable then to do, in the intellectual field, what has been done in the field of manufacture — to set up a series of formulas and rules and standards which could be followed within limits by any young man trained to that vocation, by any man who had applied that formula in that way over and over until he could satisfactorily duplicate his results. It has the advantage that this man following these standards, can arrive at the same result in Boston or in Los Angeles and whatever the condition of his health or temper. In other words the work can be checked. To that extent then something which was originally intelligent, that is, the thinking out, weighing of evidence, thinking out criteria of stability and stiffness has been standardized as on an assembly line and relatively incompetent men can be put on that assembly line to do over and over a specific operation in a clearly defined way.

Without these assembly lines and the use of mechanical brains we could not turn out the volume of work that comes from engineering offices. On the other hand every man here is thoroughly familiar with the tragic results of this standardization when used without discrimination. We are conscious of this and have set up many safeguards against it and still stupid designs result. That has not always been so, but is a result largely of this pressure for more and more work from fewer men. Medieval architecture was not standardized. This is one of its great charms. There is nothing very standard about Chartres or Mont St. Michel. You all know that a favorite topic of sculpture in medieval architecture was the Day of Judgment in which a little naked soul stands in one pan of the scale balance and the devil and various imps pull on the other scale. The conventional result was always that the soul was heavier than the devil, but in one of the capitals at Saint

Lo the sculptor, probably suffering from indigestion, reversed the procedure to the great embarrassment of future curators.

In our own field we have sometimes carried the appearance of intelligence by standardization pretty far. The first Joint Committee on concrete and reinforced concrete faced the necessity of some sort of standardization as a check on fools and rascals, but out of it has come a very narrow circumscribed standardization of procedures which is called the theory of reinforced concrete to which poor students are exposed. I think few will question that this standardized theory of reinforced concrete is perhaps as complicated a bit of nonsense as has been conceived by the human mind. It does, however, work pretty well as a check on indiscriminate unintelligence.

In general engineers do not standardize unless there is some reason for it, though this is not always the case, as you know; some wish to standardize where there is no real advantage and so fasten for a long time upon the profession a complex assembly line that has intellectual characteristics of a Rube Goldberg cartoon. But this standardization serves in part as a check on fools and rascals and, set up in part as an intellectual assembly line, has produced remarkable results. The point here is that its objectives and its methods have often been misconceived outside the engineering world. Seeing the results they have jumped too quickly to conclusions as to objectives.

Standardized Education

Why not then standardize all of our mental processes! You say no one would try that. It was tried, it was done, it exists in Europe. And I fear that we may run straight into our own pet brand of Charybdis in dodging Scylla. I am convinced also that it is likely to be tried with some deliberateness and on a huge scale and that it will be done under a cloak of humanitarianism and accompanied by the argument that thus engineering, that has become science, has revolutionized the physical world. I grant you that in the long run it will not work but in the meantime there may be much disaster before we redeem ourselves. When engineers standardize they at least confine their standardization to the pattern within which they wish to standardize — one thing for bridges, another for buildings, another for airplanes. To draw a sociological parallel they standardize within the class cult enclave that they wish to control. The temptation is to go on then to the more general standardization.

I have been very puzzled — perhaps I am simply stupid — by the recurrent statement that one-third of our people are inadequately housed, one-third of them inadequately clothed, one-third of them are inadequately nourished. We used to have a rule of three; this is the rule of one-third. By what standard, please, are you going to determine the adequacy of housing? About one-third are inadequately housed. Of course they are, and they will always remain so. If you housed them all in marble palaces, one-third of them would be inadequately housed because it would be Tennessee marble instead of Vermont marble, or Vermont marble instead of Tennessee marble. How, except by averages, do you establish the criterion of adequacy?

Irving Langmuir in a recent address especially discusses those people who talk glibly the "causes" of war. You are using "cause" now in a different sense from the physical sense. But these people seem quite sure that in introducing that concept they have now attained the certainty of physical science and the duplication of physical experiment.

Some educators are disturbed over the proposed educational program for Veterans, the so-called G.I. Bill of Rights. I share some of their fears, though some are based on misconceptions of processes of education having vocational objectives. But we must not permit education to become formalized and we must clarify its objectives and maintain freedom in seeking those objectives. I have taught students from almost every technical and from many non-technical schools both in American and many from foreign countries and I am pretty familiar with types of curricula and with their products. I have never found that any particular school was predominantly successful in its products as they came to me. Students from some of the schools were unduly burdened with details of learning. I have heard some engineers go so far as to say that the function of the technical schools is to teach a man to do a particular job in a particular way. To this I definitely object. I do not think that the purpose of the technical schools is to meet the needs of any particular industry and here I find welcomed support from many leaders of industry. The function of the universities is to turn out intelligent men with some knowledge of some practical fields rather than to turn out non-intelligent men with detailed knowledge of limited fields.

Some of the best educated men that I have known — I dare say that many here will back me up — never saw the inside of colleges until they went there in later life to give commencement addresses or to sit as members of the corporation. But today I find a growing obsession for academic credits and guinea stamps of learning and a growing confusion between literacy, training, learning, and wisdom. The tendency to standardization in fields outside of engineering is apparently inherent in animal nature; habit and imitation are inherent in our makeup. But most of us welcome a break from this standardization — most of us come eventually, if it goes too far, to hate it bitterly.

In education I think we are trying to give the man an opportunity, with some content, with some purpose, with some interest, to freely develop his intelligence to think things out for himself, to arrive at some conclusion new at least to him. The textbooks do not help much here. I had occasion sometime ago to take over a class in Sophomore Mechanics and nearly wrecked the course. As soon as I examined the textbook I realized that it was written in terms that no engineer uses, contained definitions with which I could not agree, and stated so-called fundamental principles that did not exist. Some groups in mechanics had apparently decided to standardize certain fundamentals, certain terminology and so long as that terminology suited them it bothered them little that it had no point or purpose in the outside world. Now the academic world is very much over-standardized. There is no parallel in reality for the distinctions that appear to exist in universities between the activities of the various departments. The graduate soon discovers this. The distinctions are the result of a need for organization followed by the over-organization that we all recognize in offices, technical societies, governments and most human activities.

So far as the student is concerned, I would sooner he thought wrongly on his own feet than to sit on my lap and think correctly. In that way I have some chance to make a man if the student discovers that God gave him his brain to work with.

Many of you knew George Swain. I studied under him. What did I learn? I do not now know what specific facts I learned from him. I do not suppose I think out many problems in structural engineering as I heard them from Swain. But this I got from Swain — as did hundreds of other engineers, that one day in the classroom it dawned on me that I could think something out, that my opinion might be important, that I might be right. Soon the student saw in quite a number of cases he could think correctly, and then the lid was off.

One of the latest slogans in the educational field is education for citizenship. When, please, was education for anything else but citizenship — but do you mean standardized citizenship and is it to be your standard or my standard of citizenship? Is the student to be indoctrinated with all sorts of nostrums, the knowledge of which are alleged to be prerequisite to good citizenship. Some of you have read Graham Sumner's essay on the "Forgotten Man." This forgotten man was a nonconformist, the ordinary fellow who attends to his business as best he can but outside of any technical requirement forms his own decisions. Sumner points out that this man becomes the butt of ridicule or focus of attack of enthusiasts who insist that he be standardized and closes the essay with the apposite remark that "the forgotten man — who is frequently a woman — works and possibly prays, but you may be sure that he always pays."

I am not here criticizing any particular form of education. I do not know what is the proper form of education; I think there is no proper form. I think it a mistake for a man to go into education for narrowly vocational objectives though I see no objection to this if he recognizes that what he is getting is training and not education nor do I see that education in structural engineering is necessarily more narrowing than classical studies on terminations in T in Terence. Mr. Hutchins has recently said that some bad education is worse than none and more bad education is worse than less. This needs to be stated and restated over and over.

There is a rather naughty little book of poems produced in Australia called "It Is 'Ard to Stay Clean in the Country." One stanza is:

"It's 'ard to stay clean in the country
Where you rise for the milking at three
And a lean on the gate is an offer to mate
And love, though it's silent, is free."

I have seen this parodied:

"It's hard to think straight in a college
When you al'us stop working at three
And for answers you look in the back of the book
Skill, knowledge and wisdom are free."

Dangers of Overstandardization

The thesis to which I have struggled is that the attempt to send too many people to college with too vague purposes simply to learn standardized forms of fragmentary knowledge is dangerous. It is only recently that Hitler has taught me how very dangerous the pretense of education may become, not dangerous in the old fashioned sense but dangerous in the ghastly horrible sense of modern war and modern Europe; I begin to see threats of it here called education for citizenship. It rejects the concept of the free man thinking through the world in which he lives, its past, its present, its future so far as God gives him the intellect to do so. Perhaps I exaggerate. The Pope's Christmas message again emphasizing the importance and sanctity of the individual and individual thought was a bright spot in a dismal world. I still have an abiding faith that the dreams of yesteryear are here today and that this dream of the individual, an unstandardized free man persists. In great schools — not large, great — free men work in an atmosphere of great thoughts, of great faiths and great dreams. The thoughts need not be couched in stilted or artificial or technical language, the dreams need not be nightmares. I do not know what liberal education is; I have heard too many and varied definitions of it. Many who urge for it get far from liberalism. You will all recall, when years ago someone defined a progressive as "one who works with his face toward the light," it was suggested that the definition be improved to read "a progressive is one who works with his face." But whatever constitutes liberal education, the dream of a whole man in a whole world must not be swallowed up in vocationalism. The concept of education must be one of service and not of self-promotion. The dream of an individual who stands squarely on his own feet, whose intelligence is independent of dictum and dogma, who looks with faith at the future and smiles, carried us across the continent and must not be lost.

The flood tide of progress always comes slowly from far back through creeks and inlets of individual thought. I have chosen to speak on this topic because I think that men with your influence are in a position to clear at times the channels through which this flood of progress may flow; you are in a position to insist that these channels should not be obstructed for purely hypothetical experiments on humanity.

PRESIDENT WESSMAN: Many years ago, gentlemen, a young lawyer came to Chief Justice Marshall and asked him what were the prerequisites for a Supreme Court Judge, and the Chief Justice replied, "The primary requisite for a Supreme Court Judge is the ability to look a lawyer straight in the eye for two whole hours and not hear a damn word he says."

Well, on the strength of that definition, I thought we might have a few Supreme Court Justices among our group, but I watched you closely and I didn't see a single one who would qualify. You were listening to what our speaker had to say, and I know that as a result of that you do have some comments to make.

The meeting is now open for discussion.

MR. PHILIP W. HENRY: Mr. President, in view of the rather abstruse subject to be discussed, and in order to save time, I have taken the liberty of committing my remarks to paper which I shall read:

Professor Cross, in selecting the intriguing and rather cryptic title to his address, "Standardized Intelligence" has somewhat baffled those of our members who are wont to discuss at these annual dinners the views set forth by the speaker. Intelligence of course has nothing to do with literacy, for there have been men of great intelligence who could neither read nor write. Several weeks ago here at the University Club I happened on a recent book from which I make two quotations that have a bearing on the subject. In this book by Professor Merriman of Harvard University entitled *Suleiman the Magnificent* he says:

> "Murad I was 41 years old at the time of his accession in 1359, and a truly remarkable man. Primarily a soldier of Islam, stern, severe and recklessly brave, with a tremendous voice which thundered over the battlefield, he was also a great builder of mosques, of almshouses and of schools. And yet he could neither read nor write. When his signature was needed he dipped his thumb and three fingers in the ink and applied them — well separated — to the paper."

Like other qualities — physical and mental — intelligence may well be a blend of natural gifts and varied training. From the book above noted I make this other quotation, telling of the sort of people that composed the court of Suleiman, as written by a European visitor:

> "They do not believe that high qualities are either natural or hereditary, nor do they think they are handed down from father to son, but that they are partly the gift of God and partly the result of good training, great industry and unwearied zeal."

These quotations confirm the definition of intelligence given in the Oxford Dictionary which is: "The faculty of understanding"; for understanding requires natural gifts coupled with education and environment. Although it would be impossible to standardize natural gifts, because there are two billion people in the world, all of whom differ in this respect, we can readily see how education and environment may be standardized. The German Nazis have endeavored to do this by the banning of books that are opposed to their ideas, and by propaganda so skillfully outlined in Hitler's *Mein Kampf* and so artfully carried out by Goebbels. Such propaganda can be overcome only by presenting the other point of view, which permits unrestrained access to history and to views expressed by all sorts of people, both ancient and modern. On account of the great variety of these views, it is not likely that even education can be fully standardized, much less that natural gifts can be brought to a common level.

Standardization finds its proper place in the world of physics and mathematics. Two plus two always make four; and no propaganda can alter that fact. By means of such mathematical laws the progress of technology has been made possible. So while it is profitable to standardize mathematical laws relating to the material world, no such standardization is possible in the immaterial world of human nature.

Nevertheless, while intelligence, as such, cannot be standardized, it can be warped through improper education and unfavorable environment, and therefore may become a menace to the world. As an illustration, we may cite the leaders of the Russian Revolution, Lenin, Stalin, Trotsky and the others, all of them well endowed by nature, but led away by the doctrine of Karl Marx to the great detriment of the Russian people. Having started out with the Communistic slogan: "From each according to his means, to each according to his needs," it was discovered by the more intelligent leaders that Communism would not work. Stalin, whose natural gifts were of a more realistic type than many of his associates, liquidated those who did not agree with him, established the bonus method of reward, thus throwing Communism overboard, and adopted State Capitalism as his economic system.

Further back we find Plato, a man of great natural talents, who was so misled by his environment and possibly by his preceptor, that he advocated in his Republic a vigorous and extensive program for training a select group that were to constitute the philosopher kings. They were to have their natures made over and to become the fuehrers of their time and society. The mere fact that no nation has adopted Plato's plan since its announcement 2300 years ago indicates its impracticability. Perhaps Plato here relied too much upon *reason* and did not give due weight to the *emotions* which antedate reason in human beings. In other words, he based his theory not on human beings as they really are, but on human beings as he thought they ought to be. Plato, in this instance, may be characterized as Rousseau characterized the Abbe de St. Pierre, a contemporary philosopher, of whom he said:

> "This extraordinary man — an honor to the age in which he lived, and to the human species, and perhaps the only person since the creation of mankind whose sole passion was devotion to reason — wandered nevertheless, in all his systems, from error to error, by attempting to

> make men like himself, instead of taking them as they were, are and will continue to be. He labored for imaginary beings, while he thought himself employed for the benefit of his contemporaries."

According to press reports the University of Chicago, under the leadership of President Hutchins and Professor Adler, is going to base its educational program on the philosophy of Aristotle, while St. John's College prefers the philosophy of Plato. If this be the trend of the times, may we not be in danger of paying too much attention to pure philosophy and not sufficient attention to history, which may be termed applied philosophy in the same sense that engineering is termed applied science? In order to design a power plant the engineer would not have to make personally the experiments of Faraday a hundred years ago, which led to the application of electricity to motors. But he would take advantage of the history of that accomplishment and of the more recent accomplishments of scientists and engineers. For this workaday world of ours, neither pure science nor pure philosophy is enough. We should know the history of the application of both, extending over the years.

Now, this is not entirely the opinion of an engineer, for a former Professor of Philosophy, Will Durant, in the preface of his recent book on *Cæsar and Christ,* after defining philosophy as "the quest for understanding through perspective" says:

> "We may seek perspective through science by studying the relations of things in space, or through history by studying the relation of events in time. We shall learn more of the nature of man by watching his behavior through sixty centuries than by reading Plato and Aristotle, Spinoza and Kant."

With this conclusion of one who is noted for his study of philosophy and history I thoroughly agree.

DEAN THORNDIKE SAVILLE: Mr. President, Dr. Cross has presented one of his usual witty and thought provoking speeches. I am in agreement with much of what he has said. However, I cannot share his apparent concern that in the lay mind the engineer is becoming confused with the scientist, and hence needs to explain the limitations of his profession. I feel that the late Professor Swain, to whom Professor Cross has referred, would have been the last person to "explain" his profession. He was proud and almost arrogant with respect to the dignity and scientific character of engineering, an attitude which I think it would do no harm to emulate when it comes to explaining engineering to the layman.

It is true that engineering is not an exact science, but engineers are applied scientists, and as such it seems to me that rather than "explain the limitations of their methods and the uncertainties of their science," they should indicate the need of the public for the professional judgment of the engineer. To my mind, the engineer *is* a scientist, and increasingly so. He knows and applies the facts of science, but it is his professional judgment in interpreting science as applied to engineering works and operations which distinguishes the engineer from the pure scientist or the artisan. Particularly is this true of the consulting engineer.

Probably no one of us here tonight has made greater contributions to engineering science than Professor Cross. I at any rate think of him as both scientist and engineer. As a matter of fact I suspect that there is little fundamental difference in what Professor Cross has said and what I have tried to say, other than in terminology. Words can mean so many different things, depending upon how they are used and their context. Professor Cross has certainly made us all think, and I am sure we are all most grateful to him for his illuminating and witty address.

MR. CARL H. STENGEL: Dean Saville said something about Professor Swain being rather hard. Professor Swain was a very dear friend of mine. Professor Swain used to send me young men during the summer from 1905 to 1910 from M.I.T. I kept track of them. They came from different classes; boys with golden spoons in their mouths, and others.

I think Dr. Cross knows better than anybody that he was one of the most wonderful engineers. I wasn't a student of his. I just met him through the students from M.I.T., who did a wonderful job.

MR. WALTER D. BINGER: Mr. President, as the recipient of one of those carbon copies, including the outline of Professor Cross' very brilliant speech, I decided that I had better wait until he spoke and make a few notes on the way. I wrote down some key words as he said different things because his talk was so full of ideas that I had no time to do any writing but that.

When he spoke of prejudices, I wrote down the word "Vincent." That referred to Dr. Vincent of Rockefeller Institute, who also thought of prejudices at one time. Someone came to Dr. Vincent and said, "I think we ought to take Dr. Blank. He has some new ideas." And Vincent said, "Oh, Blank never has any new ideas; he just rearranges his prejudices." (Laughter.)

I was also a student of Professor Swain. Swain seems to have fathered most of the men in this room. There was one year when Harvard and M.I.T. were joined, and I had Professor Swain in Structures.

Swain was a marvelous teacher, but he was an awfully tough man for the ordinary run-of-the-mill student, like myself. For a man who didn't intend to go into teaching, it was very difficult to follow Swain. I think I can best illustrate that by telling you about the last hour-exam before the final Structures examination, at M.I.T. We had come there all primed with every bit of indeterminate structures we had ever known. However, he gave us a paper which was blank except for one sentence at the top of the page which read: "Derive the end velocity of a falling body." That is all there was on it. We hadn't thought of that since our freshman physics. Professor Swain wanted to see whether we had taken anything through the Institute with us, and, God knows, we had not. (Laughter.)

When Dr. Cross spoke of the necessity for an engineer to find out whether materials were available if designed according to some standards, I wrote down the word "Russia."

A number of years ago Mayor LaGuardia asked me to receive and entertain the President of the Sanitary Trust of Russia. He had an interpreter and I had an interpreter, and we got along very well through them. Our country was in the midst of a depression at that time, and I said, "Don't you think you could take along about one hundred engineers from over here? We have some wonderful engineers who are out of work." And he said, "No, we can't use American engineers in Russia." I said, "Why not?" And he said, "Because they design to standards. If they figure that an I-beam is a five-inch beam, they know they can't get anything but a six-inch I-beam so they use a six-inch I-beam, and by the time they are through they have used enough extra material that we could have built half the building over again."

I said, "Where do you get your engineers?" He answered, "Germany and Switzerland."

Now, that does not mean to say that we should not design for our purpose; but it certainly means we ought to contemplate the other.

When Professor Cross mentioned the way of life of the engineer, I wrote down the word "wife." I am one of those engineers who brings engineering into the home and does things around the home on an engineering basis. My wife, after fifteen years of blissful marriage said to me about six or seven years ago, "I have finally found out what really constitutes the engineering mentality." I said, "Well, that is very nice. I haven't found it out yet. What is it?" And she said, "An engineer will spend six hours in order to conserve recurrent efforts, all of which together only take an hour and a half." (Laughter and applause.)

DR. ARTHUR S. TUTTLE: The name of Professor Swain has been referred to by each one of the speakers. There is one thing I would like to say about the work of George Swain that I doubt if anyone in this room is aware of, except the speaker.

It was my good fortune to serve as a Director of the American Society of Civil Engineers at the same time that Swain was a member. I got to know him very intimately in the Board, and the acquaintance was later continued socially and professionally.

I had the greatest admiration for him. One of the things he did for the engineers that is outstanding was to write the code of ethics that was adopted by the Society, which I believe was the first ever adopted by any professional organization in this country. I was a member of the Committee charged with the responsibility — something I am very proud of. But, as usual, the Chairman did the work, and he was the Chairman.

In behalf of that code, may I say that during all the years that have elapsed, to the best of my knowledge and belief, there has been only one amendment made to it, and that was to make sure that engineers holding salaried positions did not get any preferential consideration in competition with engineers in private practice.

I think that is the greatest tribute to Swain that I could offer. (Applause.)

DR. HARRY S. ROGERS: Mr. President, I, too, received one of these outlines of Professor Cross'.

Hardy Cross spoke about engineering as a way of life. He knows as well as I know that statement was plagiarized. That original quotation with regard to "way of life," came from the people in the liberal arts schools who for generations have been saying that engineering education may teach a man how to earn a living, but that a liberal education would teach a man how to live.

He demonstrated in his talk this evening that engineering in his own judgment and experience is something more than standardized thought. Yet I don't think he has denied the existence of some standardization in scientific and technological thinking. There is standardization in it. How much of the type of thought that we get in engineering that is realistic, that is truthful, transfers over into the other field of life is difficult to say.

I would like to confront the liberally educated people with three very definite sets of facts which they must answer in the framing of any cultural program. The first one is related to intelligence. Most of the young men and women who come to our educational institutions are given the Thurston Intelligence Test, put out by the American Council of Education and used almost universally throughout our system of higher education. Where these tests are given to lawyers, doctors, business administration students, liberal arts students, agricultural students, and what-not, the engineering student's norm for that particular institution is higher than any other group — universally so. They rank higher in intelligence than any other group which comes to our colleges.

I think that is something of which we can be justly proud, and that is one of the reasons why it would be difficult for us to standardize engineering education. The boys are too smart for us. They won't take it in its standardized form.

A few years ago the Carnegie Foundation made a study of higher education in the State of Pennsylvania. Those liberally educated got up a test of general culture which they gave to all of the college seniors in all of the colleges of the State of Pennsylvania. And who do you suppose came out lowest on those tests? I presume that the culturally educated thought it would be the engineers, but it was the people in the normal colleges who were training to be teachers. They ranked at the bottom. Now who do you suppose came out at the top? It was the engineers of the University of Pennsylvania. They ranked highest in general culture of all of the seniors of the State of Pennsylvania.

I should like to add another fact to that, which is not so objectively established, but which can be testified to by any of those present who have worked in large educational systems and sat on student disciplinary committees.

Among all of the behavior problems that come before the disciplinary committees of our universities and our large colleges the incidence of misbehavior in the engineering schools is lowest.

I sat on the disciplinary committee of a large institution for many years, and we seldom had a case from the engineering school come before that committee.

How much of the influence of truth and reality the engineer got in his training is transferred over into his general life I don't know, but I do have a firm conviction that there is a great value in the realistic discipline of our engineering training and in our method of thought.

However, I am not one of those who believe that we can solve all the problems of the world. I don't think we have any evidence to that effect. I do think that we constantly make mistakes when we turn to the problems in the social field and to the problems in the human field and endeavor to apply engineering methods to them. I think we fail to recognize the difference between these two methods of thought, and the liberally educated fail to recognize the distinctive things in our engineering method of thought.

I think the differences can be pointed out briefly. In engineering thinking, in the main, we deal with the quantitative and with the objective, whereas over in the humanistic and social fields we must deal with the qualitative and the imponderable. The nature of the problems, is quite different. They deal with subjective personal problems, with the complex and the integrated; we deal with the elemental. They deal with the theoretically illusive; we deal with the theoretically abstract. In regard to motives and objectives, we are seeking knowledge, and they are seeking wisdom. They deal with the appraisal of human values; we deal with the understanding of natural and economic forces. They deal with codes of conduct; we deal with the control of forces. When it comes to attitudes, they deal with a great many things; with the conventional, with the dogmatic, with prejudice, with the contemplative, with traditions. We, on the other hand, in our attitudes are iconoclasts, we are practical, critical, skeptical, active, open-minded, and independent.

When you get further into method, in all of our basic thinking our method is the generic method. We use the law of conservation of energy. They use the genetic method in contradistinction to that. They deal with the history, with the story of the case. These methods of thought are quite different.

We should recognize this when we turn to problems in the humanistic, social field. However, if one specialized solely in the scientific method of thought on the one hand, he may quite readily become a bore. If he specialized solely in the liberal method of thought, he might, on the other hand, quite readily become a snob.

What we want in engineering, what we want in education, what we want in our own thinking is a combination of those two which will really produce thinking men. (Applause.)

Colonel R. H. Tatlow, III: I have some sort of distinction here. I didn't get one of the papers, and I didn't know Dr. Swain. I am a little bit handicapped on that.

I was insulted the other day, and I think that you fellows were insulted, and I want to talk about the facts. Consulting engineers have a lot of intelligence, and they are pretty egotistical with a high regard for their services.

The other day a friend of mine who is an officer in one of the large corporations in my city said that he just settled a bill with a bond counsel. This bond counsel charged him $125,000 for reporting on the adequacy of financing for the Capital Transit Company in Washington. That is a very interesting case, now before the SEC for approval of the bond sale.

He said, "You are an engineer. Pretty proud of it, too. The lawyers submitted a bill of $40,000 for saying that the bond was a pretty sound bond and was according to the law, and so forth. The engineers were asked to answer many questions such as, is the company well equipped, does it have a very good system from an operating standpoint; what is the value of its present equipment; is this system going to last over a long period of time; are they safe in putting their money, some forty or fifty million dollars, into it?" The engineer said, "Yes," and he got $1,400 for it. (Laughter.)

Now, we have here an Institute of Consulting Engineers, and have tonight talked much about the standard of intelligence. I am not much on technicalities of intelligence because you fellows know too much, but I think that we have a need to say something in our own behalf and say it pretty strongly to the people who are setting those fees and paying us for our services. It is rare that one gets a chance to talk to the men who are presidents of all the societies, past, present, future. You also have many of the directors here. I say it is up to all of us to do something about it. (Laughter and applause.)

MR. GEORGE W. BURPEE: I think the Colonel is right. We have the President of the American Society of Civil Engineers, we have the incoming President, and we have at least five other Presidents of our sister societies.

I want to thank Professor Cross for the statements he made about the self-abnegation of engineers. I am tired of hearing the statement that engineers can't talk and engineers can't write. Some of the finest users of the English language that I know, and I pride myself on being quite conversant with literature, are engineers. Engineers can read Greek, Latin and appreciate it. Engineers can read French, German and Spanish. They can read all the languages.

I have never heard Professor Cross make a speech but that I have felt that the engineering profession was ennobled by having a man like Professor Cross that could bring out the best, the highest of the ideals that there are in the engineering profession. I have heard him speak several times, and he always has the same effect on me.

An engineer is a man before he is an engineer. His service is to his fellow-man. It is true he is an engineer, that is the particular place that he fits in the scheme of things in economics. He is not a lawyer, not a statesman, he is not a business man, perhaps. He is an engineer, and he has his own function to fill. And in filling that function, he has done all that is required of him as a citizen.

It is part of the engineer's experience that he has to be careful in appraising and sizing up the facts on which he acts, the facts on which he bases his judgment, because if an engineer is wrong on his facts, the structure that he builds falls down.

In medicine it is an old joke that the doctor buries his mistakes, a lawyer can always accuse the Court of making an error, but the engineer must remember that his mistakes live after him, and he can never live them down, or, rather, outlive them.

I am one of those present who studied under Professor Swain. Incidentally, I antedated Professor Cross by several years. Professor Swain was a great engineer. He was a great teacher. And he had that vision of human knowledge and human wisdom that an engineer was a citizen of the world; that he wasn't any narrow-minded technician. He used to bring us together every Wednesday afternoon and read us quotations from Plato, quotations from Aristotle. You remember, Carrol, the sessions we used to have over in the physics laboratory listening to Professor Swain reading.

He believed in a broad culture. An engineer should have a sense of civilization, should have a continuity. And he believed that an engineer was contributing to that continuity and to the growth of that civilization.

I am happy to have sat here to listen to Professor Cross tonight expanding that thesis. (Applause.)

President Wessman: Isn't it interesting, gentlemen, that in a discussion of a topic such as this that the name of George Swain should recur over and over again? Likewise, isn't it interesting that so many of his former students are here in this group tonight — which probably represents the finest engineering talent in the country?

ADMIRAL R. E. BAKENHUS: I, too, received one of the outlines and in fact I wrote a letter to Professor Cross before the meeting as a result of which he kindly sent me the copy of the outline of his address. I can put the thing more definitely than our friend, Dean Saville, because Professor Cross in his letter to me said he doubted that he would follow the manuscript with any fidelity, since he almost never does.

I looked over the manuscript, but I, frankly, have forgotten what was in it after what Professor Cross has told us this evening, which was very inspiring and fundamental.

It so happens that I, too, am one of the former students of Professor Swain. I think that Professor Swain's end output was not always the same, and with apologies to all the other Swain graduates here, I want to say that I think the climax of his educational methods must have been reached about the time Hardy Cross graduated.

I had one experience with Professor Swain: — I always studied my lesson very carefully in preparation for the coming day, but this one time I didn't. I forgot what happened — I went to a party or something of that sort, and I hadn't studied my lesson. I went into the class with fear and trembling of what would happen to me, because I knew he would surely call on me.

And he had said, "Now, when you read these notes, don't take the demonstration given, as the only answer. Think of the other answers to this problem. Now, here is a thesis expounded in the notes; what other way is there of proving this proposition?"

And he went from one to the other, and they didn't know any other method. Not having studied the lesson, my mind went back a year or two when we had had the same problem in applied mechanics, so that is the answer that came to my mind, and it was what he wanted.

He pounded the table and said, "There is a man who really studied his lesson." (Laughter.)

I almost went through the floor for embarrassment but what could I do? I just let it pass, of course.

I have the greatest admiration for Professor Swain, because his effort was directed to teaching a man to think, and to think on his feet, and I believe that is exactly what Professor Hardy Cross has emphasized this evening.

I am tempted to back up what Mr. Burpee said about the engineer's use of English. I know a recent engineering report that went to a lawyer which he read over during a weekend. His son was a student in a liberal arts college, and he handed him this report and said, "Here, son, this is the kind of English you ought to write. You couldn't change a word in it without changing the sense. You couldn't take out a word or add a word." So that is one man's idea of what an engineer can do in the use of English. It is an all important matter.

However, the most vital matter in an engineer's report is not the use of good English, for after all that is only a vehicle. The report must be designed for a certain purpose and to cover a situation. These the engineer must understand. He must know the point of view of the intended reader of the report, and what the prospective reader already knows of the subject. The method and order of presenting the facts, recommendations and other items must be carefully planned. In fact the report must be "designed" to meet a purpose just as much as a bridge must be designed.

I have been impressed with the able remarks just made by President Rogers with the clear analysis of differences between the engineer type of mind and the "liberal arts" type of mind and the processes of thought and logic that result.

I have had many years in the engineering profession, with all sorts of experiences. I firmly believe that the engineering field is a widening field. I don't think that the engineering method is necessarily confined absolutely to structures or to floods and other such physical and material fields. If a problem comes to an enginneer — it might be negotiation of some problem or situation, or it might be planning a speech — then if that is thrust upon him, he should get all the facts together, plan his negotiations as he would a road system, or he should design his speech to meet the audience and the conditions that surround him at the time. I think that is the engineering approach to a problem involving human relations.

Coming back to what President Wessman has told us tonight, I think that a central organization of the Founder Societies can be worked out by applying the engineering method of analysis and constructive thought, studying first what are the aims and the objectives of the individual societies. They are not all the same. Their points of view are not the same. But the study can be made, and a fundamental point of view or objective upon which all agree may be developed.

Then the organization may be planned delegating to the central body authority to act in those fundamental matters upon which the constituent bodies agree. The study and the organization must take into account the external situation, relations with the public, with governmental bodies and with other organizations, as well as the situation internal to the Founder Societies. Finally the central organization must be administered by men of wisdom and thoroughly informed as to the purpose and limitations of the group, and who will keep aware of the basic purposes.

If that is worked out and an organization formed — scientifically like that, studying the psychological problem or the political problem, whatever it may be called — I think that the proposed organization can be soundly worked out, and have a useful life.

In the military services we have what is called "the estimate of the situation" which precedes the decision in any military problem. This is, the mission must first be worked out, the situation studied, and then a decision reached and a plan of action worked out. I believe that is an engineering type of approach to a problem. It was devised in Europe, I believe, by the older General Von Moltke. I think he was the first to devise it. It is now universally used.

That is the first thing to work out with a central organization of the Founder Societies — the mission. Once that is thoroughly cleared, then the organization follows.

I want to express my deepest thanks to Professor Hardy Cross for what he has told us tonight. It is inspiring. (Applause.)

MR. O. H. AMMANN: Mr. President, I didn't get one of those papers, nor was I a student of Professor Swain. I am a practical engineer, and should like to illustrate a practical application of the idea propounded by Dr. Cross if I understood him rightly.

I am reminded of an argument I had with one of our beloved former members, Dan Moran. He told me once that engineers design bridge superstructures with great precision, and then put them on foundations which are proportioned by guess work. I told him that he was all wrong, that while it was true that we use refined mathematical formulæ in designing the superstructure, those who know something of design will pray to God that the structure will stand up; whereas when we come to the foundations we know they are held up by the devil. (Laughter and applause.)

MR. BURPEE: I wonder if Vice-President Huie will take the Chair for one moment.

(Vice-President Huie assumed the Chair.)

MR. BURPEE: Mr. Vice-President, I don't mean to interrupt any discussion of Professor Cross' talk that the members still desire to continue, but before the meeting adjourns it seems fitting and proper that this meeting should not only give a rising vote of thanks for this very fine talk that he has given tonight to Professor Cross, but we should give the same sort of demonstration to the President of this Institute, Dr. Harold Wessman.

Dr. Wessman is not like a great many of us tottering along with old age with one foot already in the grave and walking on crutches. He still is a flourishing young man, but it so happens that the constitution of this body is that his period of elected membership to the Council expires tomorrow, and, therefore, he cannot continue as President, and the Institute must have another President.

Therefore, I want to move a rising vote of thanks to Professor Cross and, also, to Harold Wessman for the work that he has done this past year as President of the Institute.

(The audience rose and applauded.)

Vice-President Huie: I will turn the meeting back to you, Mr. President.

(President Wessman resumed the Chair.)

President Wessman: Gentlemen, I greatly appreciate this expression of sentiment on your part. There isn't anything more that I can say tonight, but in conclusion, I would like to make a brief comment to note the distinction between intelligence and smartness. One can be both intelligent and pleasant, but on the other hand, it is difficult to be both smart and pleasing to your fellow-man. The distinction is brought out so nicely by Frank Fay as that lovable character, Elwood P. Dowd, in the current Broadway stage hit, "Harvey." In the last scene of that play he is relating to his audience how he came to know his bosom companion, the six-foot, one-and-one-half-inch white rabbit, Harvey, who goes with him everywhere. He tells the group, "When I was a boy, my mother would say to me, 'In this world, Elwood, you can be either, oh, so smart, or, oh, so pleasant.' For forty years I tried to be smart; I recommend being pleasant."

Well, that was a very intelligent conclusion, as well as a sermon, on the part of Elwood P. Dowd. Taking my cue from that, I think that we had better draw this evening to a close. We have had a very pleasant evening together. We have had a good dinner and a stimulating talk — so now, I will set aside parliamentary procedure by declaring that a motion has been made, seconded, and unanimously passed that we give a rising vote of thanks to our distinguished speaker, Hardy Cross.

(The audience rose and applauded.)

(The meeting adjourned at eleven o'clock.)

APPENDIX

REPORT OF THE SECRETARY, PHILIP W. HENRY

As the activities of the Institute are detailed in the minutes of the monthly meetings of the Council, only a summary will be given here.

At the meeting of January 18, 1944, Messrs. Huie, Pirnie and Proctor were appointed a committee to consider the proper representation of engineers in Washington.

At the meeting of April 5 the Secretary reported that the Court of Appeals, State of New York, on March 19, unanimously affirmed the lower courts against the attempt of the Civil Service Technical Guild to prevent the City of New York from engaging the services of consulting engineers and architects. In this case the Institute had filed a brief *amicus curiæ* in opposition to the Guild. The Secretary presented a letter dated March 17, 1944, from Mr. E. E. Howard criticizing certain views on professional practice expressed by Dr. Daniel W. Mead in the March issue of Civil Engineering. This matter was referred to the Committee on Professional Practice and Ethics.

At the meeting of June 5 Messrs. Hammond, Goodrich and Hubbell, special committee, presented a report on good practice in billing for engineering service to governmental bodies; the full report accompanied the minutes. Messrs. Huie, Pirnie and Proctor, special committee on representation of engineers in Washington, made a report, copies of which were sent to the members. Briefly, the committee recommended: "The Joint Conference Committee can well be given authority to direct official representation of the engineer in Washington, and the Institute properly should and must be a part in the direction of that overall representation." The Joint Conference Committee is made up of the president, the previous past president and the secretary of each of the five national engineering societies — Civil, Mining, Mechanical, Electrical and Chemical. Messrs. George H. Burgess, Hubbell and Pirnie, special committee, made a report on the limitation of fees for consulting engineers by the Army and Navy to $25.00 per day; copies of this report accompanied the minutes. Briefly the report recommended joint action by the principal national engineering societies, in which the Institute should take part. The Council voted to endorse the objectives of the American Association for an International Office for Education, of which Professor Shapley of Harvard is chairman.

At a special meeting of the Executive Committee June 29, at which Messrs. Wessman, Ammann, Huie, Henry and Tuttle were present, it was voted that President Wessman and Mr. Tuttle address a letter to the Chamber of Commerce of the United States (of which Mr. Tuttle is national councillor) calling attention to the competent engineers among the Institute membership who would be available for service on Chamber committees dealing with engineering problems.

At the Council Meeting of September 6 Mr. Arthur S. Tuttle presented his views on "Reconversion" a copy of which was sent to each member, soliciting comments. Mr. Tuttle was appointed a member of the Council to serve until January, 1946, to take the place of Colonel Herman F. Doeleman, deceased.

At the Council Meeting of October 4, the Secretary reported that in answer to the recent letter of Messrs. Wessman and Tuttle the Chamber of Commerce of the United States had appointed Mr. W. W. Horner to its National Resources Department Committee.

At the meeting of November 5 the Council amended the resolution adopted by the Board of Directors of the American Society of Civil Engineers recommending that in future legislation affecting the War and Navy Departments "a maximum fee of at least $100 per diem be provided" by changing the word "maximum" to "minimum." Mr. Tuttle presented a memorandum entitled "Promotion of Post War Employment" which was referred to the Committee on Legislation. The Council endorsed the program of the presidents of the five national engineering societies — Civil, Mining, Mechanical, Electrical and Chemical — for placing defeated Germany in a position which would prevent her from arming for war, but will, at the same time, open the doors to the development of her natural resources in men and materials for peacetime use. The Council adopted resolutions recommending "that provision be made for enginering representation on advisory boards and in administrative positions, involving technological and managerial skill and experience, with adequate remuneration for service rendered." Copies of these resolutions were ordered sent to the President of the United States, to the Chamber of Commerce of the United States and other interested parties.

At the Council meeting of December 6 the Secretary reported that the Chamber of Commerce of the United States had written a letter acknowledging receipt of the Institute's resolution endorsing the plan proposed by the presidents of the five national engineering societies for the control of Germany's industry after the war. The letter stated: "This material will be of great interest to the Chamber's Special Committee on International Post-War Problems of which Mr. Sibley is chairman." The Secretary presented the report of the Committee on Professional Practice and Ethics on the criticism of Mr. E. E. Howard of certain views expressed by Dr. Daniel W. Mead in the March 1944 issue of *Civil Engineering*. Copies of this report were ordered to be sent to Mr. Howard and Dr. Mead, also to the membership. Mr. Singstad, chairman of the Committee on Legislation, presented a report on Mr. Tuttle's proposed plan for promotion of postwar employment, revised November 27. As the members of the committee were not in agreement, the matter was referred back for further consideration. Also the committee was authorized, if it saw fit, to send a referendum to the members, presenting arguments for and against, in order that they might vote thereon.

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Meetings during the year 1944 were:

January 17: Annual dinner meeting held at the University Club, 1 West 54th Street, New York, at which the speaker was Dr. Harley L. Lutz, Professor of Public Finance, Princeton University, whose subject was "Something New in Engineering; or, Perpetual Motion in Public Debt." President Bakenhus at this meeting gave an account of the year's activities of the Institute and presented his views on the relation of the engineer to public affairs as well as to technology. Both of these addresses, with discussions, will be found in the Proceedings of the meeting, copies of which have been sent to members and other interested parties.

January 18: Luncheon meeting of the Council, Engineers' Club, 32 West 40th Street, New York, at which the following officers were elected for the ensuing year: Harold E. Wessman, president; Irving V. A. Huie, vice-president; James Forgie, treasurer; Philip W. Henry, secretary.

February 2: At the luncheon meeting of members and Council, Engineers' Club, Mr. Howard F. Peckworth, a staff member of the American Society of Civil Engineers, spoke on "The Engineer and Collective Bargaining." As the speaker was thoroughly conversant with the National Labor Relations Act, he presented a fund of information on this controversial subject, which elicited considerable discussion.

March 1: At the luncheon meeting of members and Council, Engineers' Club, Mr. Robert M. Gates, president of the American Society of Mechanical Engineers, referred to the importance of closer co-operation between engineering societies. What he said brought out considerable discussion from members and guests.

April 5: Members and guests attending this luncheon at the Engineers' Club heard a most interesting address by Mr. Walter Mitchell, Jr., Director of Business Surveys, Dun & Bradstreet, Inc., who had recently returned from Algeria where he was sent by our government to examine into certain matters of economic importance. Through the kindness of Mr. Mitchell copies of Roy A. Foulke's pamphlet on "Financial Implications of the Peace," issued by Dun & Bradstreet, were sent to the membership.

May 3: At this luncheon, in co-operation with the members of the Engineers' Club, Capt. Carl A. Trexel, C.E.C., U.S.N., attached to the Office of Naval Operations, Washington, presented a restricted film on the Seabees in Action — much of it filmed under fire.

June 7: Colonel Harold B. Harris, Assistant Chief of Staff Operations, Air Transport Command, Washington, at this luncheon, Engineers' Club, gave a most interesting and informative address on "Some Engineering Aspects of the Air Transport Command." Through the kindness of Colonel Harris, copies of his address were sent to the membership.

September 6: At this luncheon held at the City Midday Club, 25 Broad Street, New York, Mr. R. H. Shreve, Past President of the American Institute of Architects, who has made a careful study of the housing situation, particularly in New York City, made an address on that subject, which brought forth much discussion.

October 4: Dr. Spencer Miller, Jr., State Highway Commissioner of New Jersey, at the City Midday Club spoke on Postwar Planning, referring especially to the plan of public works in England where he had recently spent some time. Through the kindness of Dr. Miller copies of his pamphlet on "The Planning of Public Works in Britain Today" were sent to the membership.

October 13: Taking advantage of his presence, in this country, the Institute gave a luncheon October 13, 1944, at the Engineers' Club in honor of one of its members, Colonel L. Alfred Jenny, who is Director of the Public Works and Utilities Sub-Commission, A.C.C. in charge of all war damage reconstruction in Italy, Sicily and Sardinia and directs the affairs of the Italian Ministry of Public Works. Colonel Jenny made an excellent address which was greatly appreciated by the 21 members and 5 guests in attendance.

November 1: At this luncheon at City Midday Club, members and guests heard a timely address by Dr. Claude Robinson, president of Opinion Research Corporation and former associate director of the Gallup Poll, who outlined the theory and methods of sampling public opinion. He discussed the application to the presidential election and explained the use of such methods in business and other fields.

December 6: Members and guests at luncheon at the City Midday Club were greatly edified by the excellent account of his recent professional trip to India by Mr. Frank G. Breyer of Singmaster & Breyer, consulting chemical and metallurgical engineers.

As to representatives of the Institute: Mr. Arthur S. Tuttle was appointed to represent the Institute on the Chamber of Commerce of the United States as National Councillor to serve until May, 1945, and Col. Henry M. Waite was appointed Substitute. On the death of Colonel Waite, Mr. Alonzo J. Hammond was appointed Substitute. Mr. George C. Diehl was appointed to represent the Institute on the Highway Research Board with Mr. Charles E. DeLeuw as Alternate.

Mr. Frank M. Masters was appointed to represent the Institute at the 48th annual meeting of the American Academy of Political and Social Science, Benjamin Franklin Hotel, Philadelphia, April 14-15.

Professor Hugh E. Keeler was appointed to represent the Institute on Sectional Committee, Code for Pressure Piping B31, American Society of Mechanical Engineers and on Standing Committee for Solid Fuel Burning Warm-Air Furnaces, Commercial Standard Cs 109-44, National Bureau of Standards, U. S. Department of Commerce. Professor Keeler takes the place of George A. Orrok, deceased.

Major Irving V. A. Huie was appointed to represent the Institute at the meeting of the Joint Conference Committee of the five national engineering societies to consider the status of the engineer, July 11, 1944, at Engineering Societies Building.

Dr. Dugald C. Jackson was appointed to represent the Institute at the inauguration of President Dodge, Norwich University, Northfield, Vermont.

Membership

In 1944 the Institute lost ten members by death — an unusually large number — at an average age of 73 years. J. P. Hallihan of Washington, 77 years of age on January 1; George A. Orrok, of New York, 77 years of age, on April 6; Herman F. Doeleman of Baltimore, 70 years of age, on May 30; J. F. Coleman of New Orleans, 78 years of age on June 3; Frederic H. Fay of Boston, 72 years of age, on June 5; Samuel M. Ellsworth of Boston, 49 years of age, August 13; Henry M. Waite, of Washington, 75 years of age, on September 1; Albert M. Brosius of New York, 75 years of age, on October 9; Alonzo J. Hammond of Chicago, 75 years of age, on December 2; Charles F. Scott of New Haven, 80 years of age, on December 17. Detailed memoirs will be found in the minutes of the Council meetings, so that only a brief outline will be made here.

Major Hallihan was born April 27, 1867, in Fond du Lac, Wisconsin. After being graduated from high school he began his engineering career on location and construction work on the Union Pacific Railroad. From 1891 to 1897 he served on irrigation, railroad and mining projects in New Mexico and Colorado. From 1898 to 1904 he was resident engineer and superintendent of railways connected with the Cananea Consolidated Copper Company of Cananea, Mexico. As chief engineer from 1904 to 1907 of the Rio Grande, Sierra Madre & Pacific R.R. he located 150 miles of railroad over the divide and made a reconnaissance of 400 miles to the Pacific. From 1907 to 1909 Major Hallihan was general manager of the South American Construction Co. in the building of 125 miles of railroad in Bolivia from Viacha to Oruro. In 1910 he made a reconnaissance of 700 miles of a proposed railroad in Spain, from Irun to Madrid and thence to Valencia. In the next five years Major Hallihan was engaged in railway surveys in Peru, railroad construction in Haiti and railroad management in Brazil. In 1918 he entered the United States Army, served in France and was retired in 1919 with the rank of Major. He was then associated professionally with Col. F. A. Molitor. From 1923 to 1935 Major Hallihan was executive engineer for the Rapid Transit Commission of Detroit, Mich. From 1934 he had important engineering positions with the Works Projects Administration, Washington. On its dissolution in 1943 he was made Chief of Transportation and Engineering Division, Engineering Staff, Railroads, of the Foreign Economic Administration. Major Hallihan, because of his experience in Latin America, spoke Spanish with unusual correctness and fluency. He was a member of various engineering societies to which he contributed papers. He became a member of the American Institute of Consulting Engineers in 1920, served on its Council 1932-34, where his rich experience and pleasing personality made his counsel most acceptable to his associates.

Mr. Orrok was born in Dorchester, Mass., in 1867 and received his formal education at Massachusetts Institute of Technology. After two years of teaching and six years on miscellaneous design and construction, in 1898 he joined the New York Edison Company as draughtsman; in 1907 he was appointed mechanical engineer, and in 1917 consulting engineer. Mr. Orrok's engineering work covered an unusually wide range of undertakings, including the design of floating dry docks, gas and diesel engines, mining systems and ships. Although recognized primarily as an authority on power plant engineering, he contributed important original research in the field of heat transfer, in condensers and furnaces, and organized and directed research on the properties of high pressure steam. Thus were the present international steam tables produced, the basis of present day computation of power generation and all steam problems. Always interested in education, Mr. Orrok taught steam engineering from 1911 to 1914 at the Polytechnic Institute of Brooklyn. He was on the faculty of Yale, Harvard and Princeton Universities as lecturer in his special fields. In 1929 he received an honorary degree in Mechanical Engineering from Stevens Institute of Technology. Honorary Membership was conferred on Mr. Orrok by the American Society of Mechanical Engineers in 1936. Besides his joint authorship with Professor Fernald of a text book on Power Plants, he was a prolific contributor to the literature of the engineering societies in which he was active, being chairman of many important committees and member of many others. Mr. Orrok served as consulting engineer to Union General d'Electricite de Belge; the United States Government on the Panama Canal; the United States Navy; the New York Board of Water Supply; the Busch-Sulzer Bros-Diesel Engine Company; the Chile Exploration Company, and numerous other industrial concerns. Mr. Orrok liked people and enjoyed living. His lively and dogmatic conversation was characteristic. These traits coupled with an optimistic and generous nature, gave him many friends in all parts of the world. Mr. Orrok became a member of the American Institute of Consulting Engineers in 1925 and served on the Council 1929-31.

Colonel Herman F. Doeleman was born August 25, 1874, in Hooge Zwaluwe, Netherlands, received his preparatory education at the Zierikzee High School and pursued his engineering course at the Royal Institute of Engineers, Amsterdam. In 1893, upon completion of his studies at the Royal Institute, he came to the United States and was employed in Chicago, mostly as draftsman until 1900 when he went to New York where he was employed by several engineering concerns until 1904, when he became Office Engineer and Assistant to the Contracting Manager of the American Bridge Company in Baltimore. Here he remained for eight years and was then made Chief Engineer of the Carnegie Steel Company's Baltimore plant. In 1913 he established his own office in Baltimore as a consulting engineer, specializing in the design and supervision of construction of steel and concrete buildings. In 1917 he offered his service to his adopted country and was commissioned a Major of Engineers in the Construction Division with headquarters in Washington. In 1919 Major Doeleman reopened his office in Baltimore and carried on his practice until his retirement. Having continued his association with the Engineering Corps as a reserve officer, he was commissioned a Lieutenant Colonel in 1930. Serving as a tribute to his memory are many important buildings such as the Baltimore War Memorial, the Gymnasium Building of the U. S. Military Academy at West Point and many well known office buildings in Baltimore, as well as buildings in the Johns Hopkins Hospital and University groups. In 1940 Colonel Doeleman was made Consultant to the Office of the Architect of the Capitol, and he told of this work in his paper on "Investigations for Roofs of U. S. Capitol." Colonel Doeleman was insistent on thorough study of each problem and complete adequacy of design. To his subordinates he was not only employer, but educator. He was an omnivorous reader and was proficient in the use of Dutch, English, French, German, Spanish, Italian and had recently taken up the study of Russian and Sanskrit. Colonel Doeleman became a member of the Institute in 1928, and was serving on its Council at the time of his death. He was also a member of various other technical societies and social clubs.

Mr. Coleman was born November 23, 1866, in Jefferson County, Mississippi. Soon after his graduation from the Boys' High School, New Orleans in 1884, he started his engineering career as rodman on the Guatemala Northern Railroad. From 1885 to 1888 he was successively rodman, instrumentman and resident engineer on the Frisco Lines. From 1888 to 1893 he was engaged in construction work in Pueblo, Col., and later assistant engineer, United States Engineer Corps in charge of observations on the Mississippi River and Assistant Engineer for the Texas & Pacific Railroad. From 1894 to 1899 he was with the City of New Orleans as division engineer and later as principal assistant city engineer. From 1900 to 1917 he had a consulting practice which covered municipal work, irrigation, reclamation, railroads and wharf design. During the World War, 1917-19, he acted as general superintendent of the Chicasaw Shipbuilding & Car Company (a subsidiary of the U. S. Steel Corporation) at Mobile, Ala. After the war Mr. Coleman's engineering practice extended over a wide range of municipalities — Jacksonville, Charleston, Mobile, Freeport, Houston, Corpus Christi, Beaumont and New Orleans. Other engagements embraced industrial plants, warehouses, wharves and foundations. In 1932 Mr. Coleman became connected with the Reconstruction Finance Corporation when he was appointed to its Engineering Advisory Board. Mr. Coleman's work, as did that of the other members, included not only broad engineering questions, but also legal and financial ones. From 1933 to 1935 Mr. Coleman was retained by the Freeport Sulphur Company and had charge of the operations of the Jefferson Lake Oil Company. At that time Mr. Coleman was also associated with Modjeski and Masters in important bridge construction in Louisiana. In 1938 Mr. Coleman was asked to return to the RFC for which he did much important work up to the time of his death. Mr. Coleman was prominent in local and national engineering societies. He was past president and honorary member of the American Society of Civil Engineers, and past president of American Engineering Council. He became a member of the American Institute of Consulting Engineers in 1920 and served as president in 1928. In his practice he exemplified the principles of the Institute, and his engineering contemporaries bear witness to his honorable practice.

Mr. Fay was born in Marlboro, Mass., July 5, 1872, and he was educated at the Massachusetts Institute of Technology. Beginning a few months after graduation he was employed successively by the City of Boston as draftsman, assistant engineer and division engineer. In 1914 he resigned to become one of the founders of Fay, Spofford and Thorndike. During the past thirty years the firm's work has included the design and engineering supervision of many important structures including the Boston Army Supply Base, the Bourne and Sagamore Bridges across the Cape Cod Canal, the Crown Point and Rouses' Point Bridges across Lake Champlain, the Hampden County Memorial Bridge at Springfield, the State Pier at Portland, sewer system and sewage treatment works at Cranston, R. I., and during the present war, in co-operation with other professional firms, Army Bases in North America and elsewhere and Navy dry docks. Mr. Fay was active in civic affairs, serving as chairman and member of many important committees such as the Boston City Planning Board. He served as president of the Alumni Association of M.I.T. and later as alumni member of its Corporation. He was also prominent in the affairs of the Northeastern University. He was a member of many engineering and technical societies. In 1916 he became a member of the American Institute of Consulting Engineers, served on its Council and was president in 1927. Mr. Fay contributed numerous papers and addresses to the professional societies and was author of other works. His leadership in his profession resulted quite logically from his sound technical training, his thoroughness and vision, his physical ability to work long and arduously, his excellent judgment, his clear thinking, his administrative ability and his high character.

Mr. Ellsworth was born in Braintree, Mass., January 4, 1895. Following his graduation from the Massachusetts Institute of Technology in 1916 he had two years of field experience with the Public Health Services of Massachusetts and of the United

States. In July, 1918, he entered the Army as a private and was later commissioned 2nd Lieutenant in France, where his service was connected with water supply. From 1919 to 1922 he was with Morris Knowles, Inc., and with Weston & Sampson. From 1923 to 1925 he was assistant engineer with the Massachusetts Department of Health, and then with the North Jersey Water Supply Commission. From 1926 to 1932 he was senior assistant engineer with Metcalf & Eddy, when he opened an office for private practice. Well equipped for this venture, he developed a successful practice in the investigation, design and supervision of construction of municipal and industrial water supplies, also sewage and waste treatment. During the present war he was employed either in his own name or in association with other engineers on extensive work for both Army and Navy — Camps Edwards and Weymouth in Massachusetts; Davisville, Rhode Island; Grenada, Mississippi; Kingsport, Tennessee; and East Hartford, Connecticut. Mr. Ellsworth was a member of many prominent engineering societies and at his death he was president of the Boston Society of Civil Engineers. He was a frequent contributor to various publications. He was a hard worker, a clear-headed investigator and he had an unusual faculty for quickly reaching sound conclusions. He had the gift of making and retaining many friends who will long regret his passing at such an early age. Had he lived, no doubt he would have played an important part in the affairs of the American Institute of Consulting Engineers which he joined in 1943.

Colonel Waite, a grandson of Morrison R. Waite, Chief Justice of the United States Supreme Court, was born in Toledo, Ohio, May 15, 1869. Educated at Toledo High School and Massachusetts Institute of Technology, he was honored with degrees of LL.D. from the Miami University and Doctor of Engineering from the University of Cincinnati. On leaving M.I.T. Colonel Waite entered the service of the Cleveland, Cincinnati, Chicago and St. Louis Railway as transitman. Later he worked for the Cincinnati, New Orleans and Texas Pacific Railway as division engineer, bridge engineer, roadmaster and superintendent of the Cincinnati Division. He then served two years (1907-09) as superintendent of the Seaboard Airline Railway. He then became vice-president and chief engineer of the Clinchfield Coal Corporation. In 1912 he was made chief engineer of the city of Cincinnati. From 1914 to 1918, as city manager of Dayton, Ohio, Colonel Waite came into national prominence on account of his efficient administration of the affairs of the city. In 1918 he was commissioned Lieut. Col. of Engineers and served as deputy director general of transportation of the American Expeditionary

Forces, also with the Second and Third Armies in France and Germany. He was awarded the Distinguished Service Medal by the United States and was made an officer of the French Legion of Honor. After the war he was in private practice until 1927 when he was called to build the Union Terminal, Cincinnati, a $40,000,000 project. On its completion in 1933 he spent a year as deputy administrator of the Public Works Administration, Washington, where he organized its $3,300,000,000 program. From 1934 to 1937 he directed the Unemployment Survey, Cincinnati. He was then recalled to Washington where he had charge of a variety of projects of substantial magnitude, particularly with reference to the work of the National Resources Planning Board. From 1940 to the time of his death he was Consultant, Bureau of the Budget, Executive Office of the President. Colonel Waite became a member of the American Institute of Consulting Engineers in 1939 and made an address on "The Engineer and Post War Planning" at a special dinner meeting of the Institute, November 6, 1942. After his death, an unusual number of distinguished public officials, associates and friends paid tribute to his memory in letters to his widow, the former Mary Mason Brown, whom he married April 15, 1914. From these letters he was indeed a man of parts — able, just, human, friendly, lovable, the ideal for young men to emulate.

Mr. Brosius was born July 4, 1869, at Baltimore, Md. He attended Private preparatory schools in Ohio and took the first two years of the course in Mechanical Engineering at Purdue University. The first twelve years of his experience were spent in various parts of the United States, including California, New York City, Baltimore, Washington, Newport News, and Houston, as draftsman, instrumentman and assistant engineer on surveys and construction of railroads and real estate developments, and municipal improvements. As an assistant engineer, Mr. Brosius worked on Rapid Transit Subway Construction in New York City and as engineer in charge of design and construction of sewers and subsurface structures on the Hudson River Tunnels, from 1902-05. In 1906 he accepted a position for the City of Baltimore as Principal Assistant Engineer in the design and construction of a large sewer system for the city; during part of this time he was acting chief engineer for the project. Mr. Brosius was then called as chief engineer for the Havana Sewering and Paving contract on a large sewerage project in Havana, where he supervised the design and construction. On the completion of this work, Mr. Brosius opened an office as a consulting engineer in Los Angeles where he served as a member of the Board of Sanitary Engineers for Los Angeles County. During the first World War he served as superintendent for transportation and materials on the construction of the U. S. Quartermaster's Depot and Ordnance Warehouses, Charleston Port Terminal, Charleston, S. C. He afterwards served as senior engineer for the U. S. Shipping Board Emergency Fleet Corporation, Washington, D. C., until 1921 From 1922 to 1927 he was employed by Fuller & McClintock of New York City in the design of water supply and sanitary projects and by the J. G. White Engineering Corporation, with an office in Guatemala, on large municipal improvements, including water supply, electric railway, and hydro-electric work. From 1928 to 1932 Mr. Brosius had an active part in the development of the designs for the sewerage of Westchester County, working with Mr. W. W. Young, Consulting Engineer. The City of New York developed numerous projects for sewerage and disposal works, on which Mr. Brosius was engaged as a designing engineer from 1932 to the date of his retirement in 1939. Since that time he had been a consulting engineer in New York City. Mr. Brosius was elected a member of the Institute in 1937, and took a great interest in its affairs. In 1903 he was married to Edith Helen Coakley who survives him. A son, Albert M. Brosius, Jr., also survives.

Mr. Hammond was born in Thorntown, Indiana, April 23, 1869. He received his early education in the public schools of Frankfort, Ind. In 1889 he was graduated from the Rose Polytechnic Institute with the degree of B.S., receiving his M.S. in 1894, C.E. in 1898 and D. Eng. in 1933. In 1890-91 he was a special student in sanitary engineering at M.I.T. Upon graduation in 1889 he was appointed city engineer of Frankfort, Ind., and served until 1898. Then for three years he was assistant engineer Terre Haute & Indianapolis R.R. Co. From 1901 to 1910 he served as city engineer of South Bend, Ind. At the same time he practiced as a consulting engineer. In 1908 he helped organize the Union Trust Company, South Bend, and became vice-president and director. In 1910 he was employed by the City of Chicago to report on the 14-foot water tunnel from 73rd Street which extended to the 4-mile crib. From 1912 to 1913 he served as Engineer of the Bridges and Harbor for the City of Chicago. From 1914 to 1922 the Chicago Union Station Company employed him first as consulting engineer and later as assistant chief engineer in charge of design and construction. This project serves the Alton, Burlington, Milwaukee and Pennsylvania railroads. From 1922 to 1928 Mr. Hammond gave his engineering services to two important engineering and construction corporations. In 1928 he opened an office in Chicago as consulting engineer, and he served the City of Chicago, Pittsburgh Street Railways and the Reconstruction Finance Corporation on various important projects. As president of American Engineering Council in 1939 Mr. Hammond became interested in the problem of increasing the members and caliber of engineering personnel in the service of the Federal Government, and became a member of the Construction and Advisory Committee of the Army and Navy Munitions Board. The work of this committee was largely completed in 1940. Early in 1941 Mr. Hammond became special adviser to General Somervell and was appointed a member of the Construction Advisory Committee of the Office of the Under Secretary of War. He was still in governmental service at the time of his death, and those with whom he was associated learned to value his judgment. Mr. Hammond showed a keen interest in the administration of engineering societies, having become a member of the American Society of Civil Engineers in 1904. His work for that society was recognized when he was made president in 1933 and honorary member in 1942. Mr. Hammond was fond of reading, particularly biographies and "people." He had a pleasing personality and a genial spirit, which commanded confidence. He was elected a member of the American Institute of Consulting Engineers in 1929, was a member of the Council, and served as vice-president in 1943.

The honors that came to Dr. Charles F. Scott were many, distinguished and well known. He was born in Athens County, Ohio, September 19, 1864, the son of a professor of Greek at Ohio University. His father was for some time president of Ohio University and later of Ohio State University. At the latter Scott graduated Bachelor of Arts in 1885. Later he studied at Johns Hopkins.

In 1888 his great work with Westinghouse began. He worked here with Tesla on the polyphase induction motor. At twenty-seven he was assistant electrician, at thirty-three chief electrician. These were active years of development of the Scott T connection, high voltage transmission transformers. This work alone would insure his fame. It is notable that even then he had begun his educational work by founding the Westinghouse Electric Club (1902). In that year at the age of thirty-eight he succeeded Steinmetz as President of the American Institute of Electrical Engineers. At forty he was consulting engineer to Westinghouse.

The Edison Medal of the Institute of Electrical Engineers, the Lamme Medal of the Society for the Promotion of Engineering Education, Doctor of Science from the University of Pittsburgh, Doctor of Engineering from Stevens Institute of Technology, president of the Society for the Promotion of Engineering

Education, Engineering Society of Western Pennsylvania, as well as of the Institute of Electrical Engineers — these were some of his honors. Of his great services — and these to him were much more important — his work for his professional societies, for education, for professional development and co-operation, the Engineering Societies Building in New York, the Durham Laboratory at Yale.

In 1911 he went to Yale where he was professor of Electrical Engineering for twenty-two years, and then emeritus. But retirement was not for Scott; then came his work as co-ordinator. From then on he was tireless in his work for the Engineers Council for Professional Development, for the alumni interests of Ohio State University, for the *Yale Scientific Magazine* and the Yale Engineering Association and the Connecticut and other licensing boards from Strathscona Hall in New Haven to the Engineering Societies Building in New York, to Columbus, to technical meetings — always cheerful, helpful and wise. A talk with him was always a good tonic, for he gave renewed faith that worthwhile things were always worth while.

Dr. Scott died in New York on December 17, 1944. He lies buried in Columbus. Surviving are his wife, Mrs. Emily Clark Scott; a brother, the Rev. Herbert H. Scott of Evansville, Illinois, and a sister, Miss Bertha Scott of Westerville, Ohio.

He was a member of many societies and organizations and was especially active in the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, the Society for the Promotion of Engineering Education and the American Institute of Consulting Engineers. He was elected to the Institute in 1939 and was at the time of his death an active member of the Council.